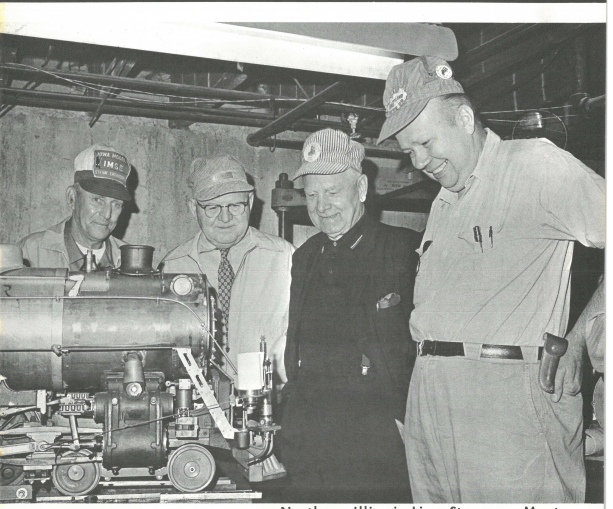
JULY
1968
45¢

Live Steam®



Northern Illinois Live Steamers Meet

Live Steam Data Sheet

Live Steam
magazine

JULY 1968 VOL. 2, NO. 7

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COVER PHOTO

A. W. Frese, Walter Johnston, Ernie Stalder and Bill Schreiber look over the pressure recorder used for setting valves on Dave Boyd's new 1½" Hudson as the Northern Illinois Live Steamers meet at Dave Boyd's track. Photo by David Boyd.

SUBSCRIPTIONS start with January, May or September issue: $4.50 per year in U.S.A. and Canada (U.S. Funds), $5.50 per year (U.S. Funds) in other countries.

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First running meet is big day for

Northern Illinois Live Steamers

by Bud Novy

PHOTOS BY DAVID BOYD

The Northern Illinois Live Steamers meet held at Dave Boyd's track on April 28th was quite a success! Attendance throughout the day reached about 100 people and they all had a good time.

Dave Boyd and Ron Pett had their 1" 4–6–2's operating, along with Russ Decho's 2–6–0 and Bud Novy's 2–4–0. Matt Fairlie's 4–4–2 was the only engine on the 3/4" track... it seems that the 3/4" operators prefer an elevated track.

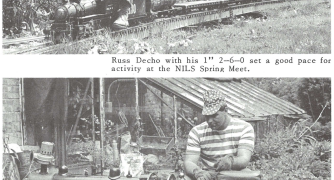
Miles Snyder displayed the chassis for the 1" N.Y.C. Suburban tank engine he is building and Dave Boyd showed his 1½" N.Y.C. Hudson which is now operating on air.

The weather was warm and sunny for most of the day, but late in the afternoon (after "Rain-Maker Fairlie" started to run) it clouded up and showered! By then everyone had quite a bit of running in but the barbeque pit was kept alight and food and drink were enjoyed by all.

A news reel of the activity was taken and shown on TV station WTTW Monday night in the course of their news broadcast.

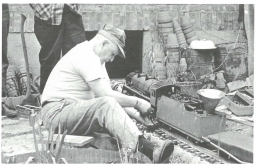
The enjoyment of this small meet made the Northern Illinois Live Steamers all the more anxious to get going on the big track on their new 7¼-acre club site just acquired.

Russ Decho with his 1" 2–6–0 set a good pace for activity at the NILS Spring Meet.

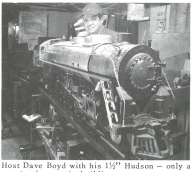


Nick Schaub fires up Dave Boyd's 1" 4–6–2 at the beginning of the day's running.

Ron Pett gives his 1" Pacific a trial run on Dave Boyd's track in Clarendon Hills, Illinois.

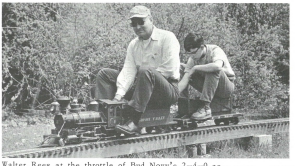


Matt Fairlie, President of the NILS, is a real down-to-earth Live Steamer as this shot shows.



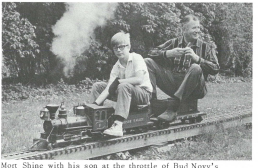
Host Dave Boyd with his 1½" Hudson – only a couple of years in building.

Bruce Achor, pioneer Live Steamer in Chicagoland, looks over Miles Snyder's 1" Suburban chassis.



Walter Rees at the throttle of Bud Novy's 2–4–0 as steam reigned for the day.

Bud Novy and his 1" 2–4–0 "Old Timer" are familiar sights in Chicago Area Live Steam Circles.



Mort Shine with his son at the throttle of Bud Novy's "Old Timer".

Harold Wood with Dave Boyd's 4–6–2 and Al Schneider with Russ Decho's 2–6–0.

A narrow-gauge Shay performs in all its glory on the

Roaring Camp & Big Trees Railroad

by Joel Tedder

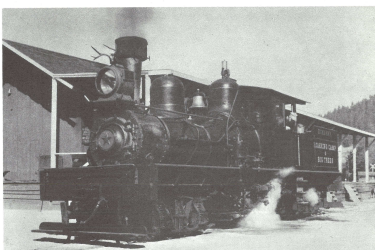
A trip to San Jose, California gave us the opportunity to run over to Felton to check on reports that the Roaring Camp and Big Trees Narrow-Gauge Railroad has been completed to the top of Bear Mountain.

After waiting around over an hour while the 2T Shay was fired up, the 11:00 a.m. departure time arrived. $2.50 poorer (price of round trip fare) and 20 minutes later, we reached the turn around loop at the top of the mountain.

It is a beautiful trip, through Roaring Camp, a tourist village across from the Henry Cowell Redwoods State Park, winding up through a virgin stand of redwoods. The route is winding to miss all of the larger trees, and loops around to gain altitude, holding grades of over 6% most of the way to the top. There are three timber trestles, the upper one crossing over the second one to create a railroad engineering marvel. Unfortunately, it is impossible to get a good picture of the trestles from the train.

Equipment that day was the "Dixiana Shay," a 2T Shay engine from logging railroads on the East coast. Two open cars and the caboose were built by H. A. Pulaski, a Live Steam modeler in 9" gauge, and R C & B T used iron parts salvaged from some old 36" gauge flat cars. The first run was a little wet —condensation from cold cylinders.

R C & B T RR is part of a project intended to roll back time to the 1880's. The railroad is built on a 180-acre leasehold which is to be developed as a tourist resort. A hotel is planned for the top of Bear Mountain, to be reached by rail only, and many recreational attractions are planned for Roaring Camp. No starting date has been set for the hotel, but enough buildings are up at Roaring Camp to make the trip worthwhile.



PHOTOS BY THE AUTHOR

ROARING CAMP & BIG TREES narrow-gauge two-truck Shay (above) building up steam for the run to the top of Bear Mountain. The 2.6 mile trip (each way) is in very scenic virgin redwood timber with grades over most of the distance at 6%+! There is talk of building a light-weight car to permit the "Kahuku" (below) to haul a payload up the grade to the top of Bear Mountain. The 0-4-2T engine was brought to California after many years of service on the Hawaiian Islands.

We'd like to have you meet

Hue Brakke,

Mr. Live Steam in Minnesota

At almost any meeting of Live Steamers in the midwest, and many other places in the United States and Canada, you are apt to bump into Hubert E. Brakke from St. Paul, Minnesota.

"How did I get interested in model building?" repeats Hue. It all started as the result of an argument concerning the proportions of the channels into locomotive steam cylinders back in the 1930's when he was a Mechanical Draftsman for the Northern Pacific Railway. Hue liked the idea of big ports – get it into the cylinder quick with little wiredrawing and then get it out – but the opposition wanted small ports with resulting decline in dead clearance volume.

"So I built a little single cylinder marine engine with twice the big scale practice steam ports. Boy did that thing turn over! It was crude as could be, but I still have it," recalls Hue.

At that time Hue already had a long background in railroading. He had worked as a laborer on the CMStP&P after graduating from High School in 1924. Then he attended Teacher's College and taught in the elementary school in his home town of Jackson, Minnesota for two years. During a four-year course at the University of Minnesota's College of Mechanical Engineering he worked during his free time as machinist helper on the CMStP&P and the B&O. Upon graduation in 1931 he became a special apprentice working at various points and in most divisions of the NP Mechanical Department on both locomotives and cars. A two-year period as mechanic on the NP brought him to the four-year spot where, as Mechanical Draftsman, he had built the single-cylinder marine engine to prove his point on port sizes. That was followed by construction of a two-cylinder engine for a tug boat and, quite logically, by the start on a ¾" scale Live Steam locomotive.

"It was a ¾" version of LHSC's ½" scale *Fayette*," says Hue, "and was running but not completed in 1940 when I was called into military service." Hue entered the service as a Lieutenant in the Anti-Aircraft Artillery but was discharged in 1945 as a Lieutenant Colonel in the Railway Section of the Transportation Corps, having completed various continental and overseas assignments.

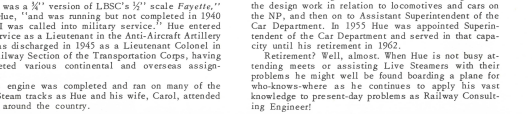
His engine was completed and ran on many of the Live Steam tracks as Hue and his wife, Carol, attended meets around the country.

Hubert E. Brakke

"It was originally known as the *Crazy Goose* from the late Lester Friend's description as to how it ran," tells Hue, "but during the years it underwent two heavy overhauls and one complete rebuild at which point the color was changed from red to green and it emerged as the *Green Goddess*."

Hue had returned to his place as Mechanical Draftsman for the NP after the war and six months later was promoted to Assistant General Foreman and spent the the next five years in that position. The next step was to Mechanical Engineer where he was in charge of all the design work in relation to locomotives and cars on the NP, and then on to Assistant Superintendent of the Car Department. In 1955 Hue was appointed Superintendent of the Car Department and served in that capacity until his retirement in 1962.

Retirement? Well, almost. When Hue is not busy attending meets or assisting Live Steamers with their problems he might well be found boarding a plane for who-knows-where as he continues to apply his vast knowledge to present-day problems as Railway Consulting Engineer!



Hue's "Green Goddess" in ¾" scale has 1 1/16" x 2" cylinders, D slide valves, 5" drivers, Baker Valve Gear, a stainless steel arch in the 5" x 8" firebox, eleven ½" flues and two ¾" super-heater flues. The engine and tender are 64" long and weigh 185# in working order. The original 125# boiler pressure resulted in a "slippery" engine so was reduced to 100#.

building the RARITAN

by William H. Morewood

With the valve gear parts completed, the next logical phase of construction would be the driving wheels and their appurtenances.

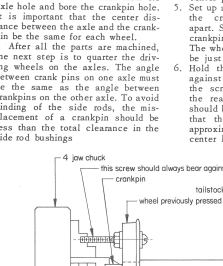
When working up the Bearing Assembly (3–1) be sure to see that the axle turns freely in the beatings and that the bearing assembly pivots without binding in the frame. The pivot permits the front axle to tilt and equalize the load on the drivers.

Machine the Driving Wheels (3–4) and bore and ream the hole for the axle. Locate each wheel from its axle hole and bore the crankpin hole. It is important that the center distance between the axle and the crankpin be the same for each wheel.

After all the parts are machined, the next step is to quarter the driving wheels on the axles. The angle between crank pins on one axle must be the same as the angle between crankpins on the other axle. To avoid binding of the side rods, the misplacement of a crankpin should be less than the total clearance in the side rod bushings

To meet this requirement, procede as follows;

1. Press all the crankpins into the wheels.
2. See that there is a small centerdrilled hole in each end of each axle to facilitate starting the wheel.
3. Press a wheel with a short crankpin on one axle and one with a long crankpin on the other.
4. Center a piece of bar stock in the four-jaw chuck and turn a center point on it.
5. Set up as shown in Figure 1 with the cranks approximately 90° apart. See that both wheels have crankpins of the same length. The wheel at the tailstock should be just started on the axle.
6. Hold the front chuck jaw down against the metal stop block and the screw in the wheel against the rear chuck jaw. The screw should be so located in the wheel that the crankpin will then be approximately on the vertical center line.



TOP VIEW OF LATHE SETUP

Fig. 1

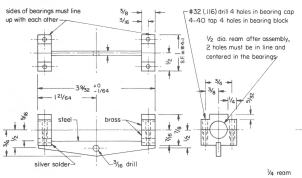
7. Run the indicator in until the extension rod touches the crankpin and moves the pointer to about 0.020. Set the indicator dial at zero. Set the lathe cross slide at zero.
8. Back the cross slide out and move the carriage toward the tailstock until the indicator lines up with the other crankpin.
9. Remove the stop block, turn the chuck back 90° and replace the stop block. When the parts are again held against the stops the right hand crankpin should be nearly vertical.
10. Run the cross slide in until its dial reads zero and note the reading of the dial indicator. Take care as you may exceed the range of the indicator on the first try.
11. Turn the right wheel with respect to the left until the dial indicator reads zero. The left wheel must be against the stops and the right wheel must be square with the axle when the reading is taken. Recheck the reading of the left crankpin. Adjust carefully until the indicator reads zero on each crankpin.
12. Remove the assembly from the lathe and carefully press the wheel on a little further. Recheck the readings on each crankpin before pressing the wheel home.

This job requires patience but with care and persistence the difference in readings of the two crankpins can be held to ±.001.

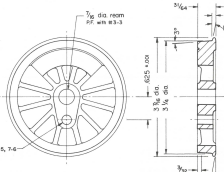
After the wheels are quartered they are sometimes keyed. This may be done by pressing a small round pin into a hole parallel to the axle, half in the axle and half in the wheel. This hole should be put in with a small end mill as a drill would tend to walk off into the softer cast iron wheel.

It has been my experience that, if the axle is 0.0005" greater in diameter than the hole in the wheel, a press fit is tight enough and a key need not be fitted.

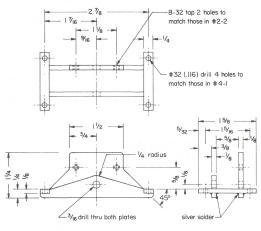
The next steps will cover the Side Frame, Exhaust Tee and Steam Header Assembly as we continue building the RARITAN.


sides of bearings must line up with each other
#32 (.116) drill 4 holes in bearing cap 4-40 tap 4 holes in bearing block
½ dia. ream after assembly, 2 holes must be in line and centered in the bearings
steel
brass
silver solder
drill
¼ ream P.F. with #3-3, 7-6

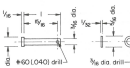
3-1 BEARING ASSEMBLY
1 required



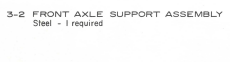
3-4 DRIVING WHEEL
Cast Iron - 4 required



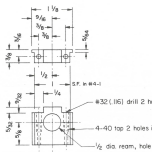
3-2 FRONT AXLE SUPPORT ASSEMBLY
Steel - 1 required



3-5 EQUALIZER PIN AND WASHER
Brass - 1 of each required



3-3 DRIVING AXLE
Steel - 2 required


S.F. in #4-1
#32 (.116) drill 2 holes in bearing cap
4-40 tap 2 holes in bearing block
½ dia. ream, hole must be accurately centered in assembly

3-6 REAR AXLE BEARING
Brass - 2 required

drawn/wet © WHR 1968

ANNIVERSARY RUN AT NORTH BARRINGTON

It's been almost a year since the gold spike was driven on Frank Saville's Palatine, Lake Zurich & Wauconda R. R., and to celebrate that occasion, Frank is planning a First Anniversary Run on August 11th and all Live Steamers are invited.

The 4½" gauge track runs for about 300 feet before crossing a trestle, rounding a 550 foot loop and returning via the trestle for a total run of about 1200 feet. It is located at Frank's home, 512 Miller Road, North Barrington, Illinois and his phone is 312 – 381-3070.

There will be running all day Sunday, August 11th and it promises to be a very enjoyable day. Plan to attend if you can.

SUMMER MEET IN MINNESOTA

The Southern Minnesota Live Steamer Association will hold a very special Summer Meet at Lake City, Minnesota, on August 17th and 18th. Track for running ¾" and 1" scale equipment will be available and the Honored Guest will be Geoffey Evans, Social Secretary of the Malden Society in England.

For routes and information about accommodations, contact Richard M. Winkle, President of the Southern Minnesota Live Steamer Association, 220 First Ave., S. W., Rochester, Minnesota 55901.

PLS MEET WELL ATTENDED

Three RARITAN engines belonging to Norman Lind, Bill Scott and Bill Moorewood were under steam on the 3½" gauge track at Paoli, Pa., over the past Memorial Day weekend. Other ¾" scale locomotives were Charlie Rowland's 4–4–2, a couple of 4–6–0's belonging to Justin Hess and Frank Watson, Linwood Crosby's 4–6–2, a 4–6–4 belonging to Elmer Roth, Roger Dudley's 4–6–6T, Henry Townsend's 4–8–2 and Jim Maxheimer's 4–6–6–4.

The 4¾" rails were equally as well occupied with running by Jim Ziegler's 0–4–0 camelback, an 0–4–0T and an Upright Boiler freelance engine by Carl Dougherty, 0–6–0's by Doc Buysee, Harold Lytel and Doug Spear, 4–4–0's by George Thomas and Stan Robinson, Rudy Blonk's 4–4–2 and a couple of 4–6–2's by Bill Normart and George Hoopes.

Leo Myers flew in from St. Louis to visit and showed movies of the filming operations of his 1" scale "General" in Spain last year as well as his own facilities. Frank Moore, Jr., showed slides and movies that he took while touring the railroad facilities in India recently.

The weather was better than even the weatherman had predicted and a pleasant week end was enjoyed by all.

RENEWAL TIME AGAIN??

The years keep rolling by and it is nearing the end of the current year of publication for LIVE STEAM.

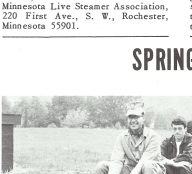
With the new Second Class mailing permit, the delivery should be faster but there is also a restriction on making individual notices of expiration as we did the last time by using the "Red Board." Such notice must now be made by separate first class mail.

If you started with us at the beginning of publication or if your subscription started with the September issue last year, it is more than likely that your present subscription expires with the next issue (August 1968) of LIVE STEAM.

Since roughly 75% of our subscriptions are scheduled for renewal in August, you can help tremendously by sending it in as soon as possible. It will speed out the work of recording the information and it may help you in the event you plan a vacation later.

Renewal notices will be sent out to those whose subscriptions have not been renewed after the August issue is mailed, so if you're not sure, don't worry . . . we'll let you know.

SPRING MEET AT SOUTHWICK



PHOTOS BY GIL RITENBURG

Robert Hornsby of Beverly Farms, Mass., drifts into the PVLS Station with Frank Dreschler's 1½" 4–4–2 from Whitestone, N. Y. on the new 7½" track. In addition to 13 1½" engines there were 30 ¾" and 8 1" scale engines in operation at the Spring Meet on May 17–19.

Jim Tumbull from Montreal (L) and Walt Kleinfelder of Summit, N. J. check out the lubricator on Jim's 1½" engine. Conversation was said to run like this: (Walt) "What do you think happened, Jim?" (Jim) "Dunno, Walt. Speck of dirt under the ball maybe."

OMAHA AREA LIVE STEAMERS: INOPERATIVE BUT NOT INACTIVE

A meeting last February with the State Labor Commissioner and the Chief Boiler Inspector caused great surprise and much interest when these men saw some of the Live Steam locomotives and learned more about the hobby . . . but nothing more at press time.

The club's B & B Foreman, Earl Keslar, has constructed a 14 x 14 foot engine house at the club track and managed to make good progress on his 1¼" 4–6–2.

Ron Beckman fired up his 1½" 4–6–2 for the first time on May 16th and it is reported to run like a $200 watch! Dual water pumps, vacuum brakes – the works.

Don Patrick is about ready to fire up the 1" 4–6–2 that he is finishing for Glen Hewitt and Bob Recic's 1½" 4–6–2 should be running on air this summer.

Club activity, though, is restricted to building a turntable and laying another 300 feet of 1" track, anticipating a brighter day without legislative restrictions.

For further information on Live Steam activity in the Omaha area, contact Secretary Robert Recic, 5022 South 93rd Circle, Omaha, Nebraska 68127, phone 402 – 331-4157.

Scheduled Meets

July

14 PUGET SOUND LIVE STEAMERS
2nd Annual Railroad Meet
4½" – 7½"
B. R. Steinhauer (Host)
4628 N. E. 92nd St.
Marysville, Wash. 98270

20 MICHIGAN STEAM LOCOMOTIVE CLUB
7½" gauge
Harry Herder's track – Kalamazoo
J. Bullock, Secretary
G–7073 Clio Road
Mt. Morris, Mich. 48058

August

11 2nd ANNIVERSARY RUN
4½" gauge
Frank Saville (Host)
512 Miller Road
North Barrington, Ill.
Phone 312 – 381-3070

17 MICHIGAN STEAM LOCOMOTIVE CLUB
7½" gauge
Jack Spalding's track – Monroe
J. Bullock, Secretary
G–7073 Clio Road
Mt. Morris, Mich. 48058

31 SOUTHERN MINNESOTA LIVE STEAM-ERS ASSN.
3½" – 4½"
Al O'Neil's track – Lake City
Richard M. Winkle, President
220 First Ave., S.W.
Rochester, Minn. 55901

24 GOLDEN GATE LIVE STEAMERS
25 Annual Fall Meet
2½" – 3½" – 4½" – 7½"
Ron Downer, Secretary
1274 36th Ave.
San Francisco, Calif. 94122

31 PENNSYLVANIA LIVE STEAMERS
1 Annual Fall Meet
2 2½" – 3½" – 4½"
Frank H. Moore, Jr., Secy.
211 Walnut Avenue
Wayne, Pa. 19087

31 RED RIVER VALLEY RAILWAY
1 Annual Fall Meet
2 2½" – 3½" – 5"
Paul Winslow, Secy.
304-1179 Grant Ave.
Winnipeg 9, Manitoba, Canada
204 – 284-5006

September

20 NEW JERSEY LIVE STEAMERS
21 Annual Fall Meet
2½" – 4½" – 7½"
Ralph Green, Secy.
845 Kilsyth Road
Elizabeth, N. J. 07208

21 MICHIGAN STEAM LOCOMOTIVE CLUB
Harry Herder's track – Kalamazoo
7½" gauge
J. Bullock, Secretary
G–7073 Clio Road
Mt. Morris, Mich. 48058

Regular Run Days

GOLDEN GATE LIVE STEAMERS
Every Sunday, weather permitting
2½" – 3½" – 4½" – 7½"
Ron Downer, Secretary
1274 36th Avenue
San Francisco, Calif. 94122

JAMUL VALLEY RAILROAD CLUB
3rd Sunday of each month
7½" gauge
Charles Underhill, Secretary
4073 Conrad Avenue
San Diego, Calif. 92107

LOS ANGELES LIVE STEAMERS
1st Saturday & Sunday each month
3½" – 4½" – 7½"
Harry Hansen, Secy.
4 Rawhide Lane
Rolling Hills Estates,
California 90274

NEW JERSEY LIVE STEAMERS
1st & 3rd Sunday's each month
2½" – 4½" – 7½"
Ralph Green, Secretary
Phone 201 – 353-4424
845 Kilsyth Road
Elizabeth, N. J. 07208

PENNSYLVANIA LIVE STEAMERS
2nd Sunday, May thru October
2½" – 3½" – 4½"
Frank H. Moore, Jr., Secy.
211 Walnut Avenue
Wayne, Pennsylvania 19087

RED RIVER VALLEY RAILWAY
Every Sunday, weather permitting, May-Oct.
2½" – 3½" – 5"
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62 Pond Street
Natick, Mass. 01760

2ND ANNUAL PUGET SOUND LIVE STEAMERS MEET

On Sunday, July 14th, trains will be scheduled to haul passengers on B. R. Steinhauer's 800-foot loop of 1" and 1½" track at 4628 N. E. 92nd Street in Marysville, Washington. Not only does the club invite and welcome all Live Steamers, but suggest that if any plan to bring their English 1" or 1½" engines the switches will be removed to permit their operation. Just notify D. G. Riches, 9511 31st Avenue, N. W., Seattle, Washington 98107 prior to June 20th or B. R. Steinhauer at his address shown above after that date. Bring along any engines or accessories for display, whether completed or not.

Messrs. Steinhauer, Riches and Von Reuden have made a number of additions and improvements to the track since last year's meet and there are excellent loading facilities, compressed air, water and electricity available! . . . as well as facilities for testing boilers and safety valves. The Puget Sound Live Steamers stress the importance of safe and sane operation.

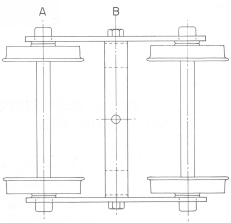
Coffee and light refreshments will be served, so bring the whole family for an enjoyable day of Live Steaming!

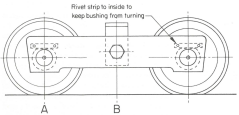
LABOR DAY WEEKEND MEET IN WINNIPEG

The Red River Valley Railway is planning a three-day meet over the Labor Day Weekend at their track in northwest Winnipeg. Their 970 foot track will accommodate 2½" and 5" gauge equipment and all Live Steamers are invited to attend.

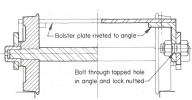
The track is in operation every Sunday (weather permitting) from May to October and for further information contact Paul Winslow, Secretary, 304-1179 Grant Avenue, Winnipeg 9, Manitoba, phone 204 – 284-5006 or Ralph Grant, President, 27 Vista Road, St. Vital 8, Manitoba, phone 204 – 256-6068.

LIVE STEAM DATA SHEET





Truck Assembly



Section A-A Section B-B

Axle Box

FROM A DESIGN BY

C. A. (CARL) PURINTON

Boxford, Massachusetts

Drawn: Carl Purinton/wcf

No dimensions are given as the drawings are intended to give the method of construction only and, therefore, can be used for any scale or gauge.

The pivot bolt that goes through the hole in the side frame is screwed through a tapped hole in the bolster angle and is locked with a nut on the inside. The hole that this pivot bolt goes through should be a bit larger than the bolt in order that the side frame is free to swivel a bit up and down.

The axle box has a flat spot on the inner flange and this goes against a piece of flat stock riveted to the inside of the side frame just over the axle box hole. This keeps the box from revolving.

The hole in the side frame for the axle box should be a free fit. In other words, if the hole is a standard size then the outside diameter of the axle box could be ten thousandths under a standard size.

One of my methods in truck-making is to allow the wheels to turn on the axles and also to let the axles turn in the bearings in the axle boxes. In this way one gets a very free-wheeling truck that is well adapted for use on lines with sharp curves.

CAR AND TENDER TRUCK

MINIATURE BOILERS OF STAINLESS STEEL

by I. Douglas Alkire

I. Douglas Alkire has been a Mechanical Design Engineer, first in aircraft work and later in aerospace engineering for most of his working years since the mid-thirties. He has had a strong interest in model railroads since his very early boyhood and was involved with HO back in 1938. He did not get interested in Live Steam until the late fifties when he saw his first Live Steamers at a Los Angeles bobby show. He learned of the location of the Los Angeles Live Steamers in Griffith Park and began making regular visits there to photograph the rolling stock. One one visit, Doug had an opportunity to run Leon Tefft's 1" Atlantic and from then on he was "hooked!"

At this point, Joseph Nelson (long a target for Doug's cameras because of his K-4s) offered to act as technical advisor if Doug would build a Live Steam locomotive. It was pointed out that by prowling the scrap sources and applying a lot of hard work a 1" Pacific would be financially possible. Doug then decided to build a 1" scale B&O Class P-7, the President Washington, *Number 5300.*

Doug is high in the praises of Mr. Laurence Sagle of the B&O Museum who sent him drawings and also Mr. H. J. Coventry, formerly with the B&O, who supplied many locomotive details.

The job was originally scheduled for two years but because of Doug's insistence of going beyond the call of duty, the job ran over 12,000 hours and spread over seven years. This includes professional quality drawings of all the small parts. Incidentally, Doug plays the organ very well and has some excellent oil paintings to his credit.

Miniature boilers of stainless steel are not unknown, but they are not common by any means. Most small boilers are made of large diameter copper tube, and the larger boilers are generally fabricated of welded steel sheet or tube.

It is felt by this writer that stainless steel of the 300-series offers many physical advantages over copper and mild steel.

Shown in Figure 1 are the relative values of a commonly used type of stainless steel in the 300-series with respect to several other materials which may be considered for use in a boiler.

The graphs show clearly the greater ultimate strength yield point, and melting point of type 304A (annealed) stainless steel than those same characteristics of copper sheet stock.

It will also be noted that the thermal conductivity, or rate of heat flow through the metal of 304 stainless steel is only 1/24th as high as that of copper, and only 2/5th that of mild steel.

The coefficient of thermal expansion, however, is almost identical for the type 304 stainless steel and copper.

It is fairly obvious that the maximum benefits of the characteristics of type 304 stainless steel and copper would be realized in a boiler with a 300-series stainless steel outer shell, back head and front flue sheet, and copper firebox and tubes. This type of construction would allow the maximum heat transfer into the water and minimum heat losses through the boiler shell to the outside atmosphere. There may, of course, be some fabrication problems involved in attaching a copper firebox to a stainless steel mud ring and stainless steel stay rods with leakproof joints.

This writer chose to construct his locomotive boiler completely of stainless steel except for copper tubes. Every piece of the stainless steel is welded into place, including the stay rods. The copper tubes were flared into the flue sheets at each end and silver brazed for positive sealing. The theory behind this plan of action is as follows: The heat *not* absorbed into the water in the crown sheet area (because of the very poor con-

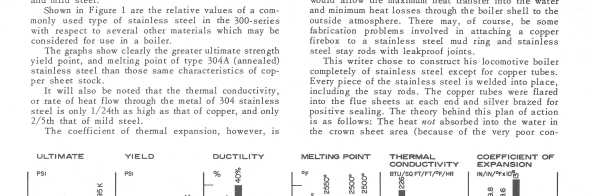


FIG. 1

ductivity of the stainless steel) will cause the firebox gases to be hotter at the point of entrance into the tubes than would be the case with an all-copper boiler. The rate of heat transfer into the tubes will be higher than that of an all-copper boiler because of the higher gas temperatures, and, since the tubes make up 84% of the wetted heating area in the boiler, the poor heat transfer in the firebox does not appear to be a problem.

On the other hand, the low conductivity of the stainless steel outer shell of the boiler is of immense help because it prevents a rapid loss of heat to the outer air. This reduction in heat loss, in turn, reduces the requirements for heat input into the water and thus raises the efficiency of the boiler.

FABRICATION

An outstanding advantage of 300-series stainless steel is its weldability. Welds may be made by almost any known method of welding. Welds are strong and tough and are generally as strong as the parent metal.

Butt welding and corner welding, including fillet welding, are the most common types required on a locomotive boiler shell. Rosette welds may be used at both ends of the stay rods. There is no need for space-wasting riveted lap joints. Typical welded joints are shown in Figure 2.

This writer's boiler was fabricated from #11 gauge (.125") type 321 sheet stainless steel. The metal was marked from flat pattern templates of the various sections of the boiler, cut out, and then taken to a commercial sheet metal shop to be rolled up into circular shell sections or formed as required. Cross section templates were used to check the forming and insure proper fit-up for the welding to follow.

The edges which were to be butt-welded were ground and filled to a 45° bevel on each side before forming-up of the parts.

The conical and circular sections were closed with longitudinal butt welds which were made with 3/32" diameter type 316 stainless rod. Tack welds were made sections. The riser ring for the steam dome was welded into the proper section prior to installation of that section in the entire boiler shell. All parts which required inside welds were installed at the time when accessibility was maximum. It was necessary to write a plan of action ahead of time and follow it implicitly. The back head was the last piece of the outer shell to be welded into place. 3/32" diameter type 316 stainless steel rod was used for all welds.

The four bar stock pieces of the mud ring were fitted to the outer shell of the boiler, tacked to each other, removed from the boiler shell, and welded into an integral ring.

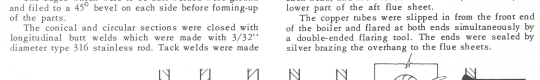
The four pieces of the firebox shell, #12 gauge except for the .250" aft flue sheet, were assembled together with the mud ring, tacked, and welded into an integral assembly. The firebox stayrod holes were located, drilled, and countersunk on the non-wetted sides. The boiler shell stayrod holes were similarly located and drilled, and countersunk on the outer, non-wetted surfaces. In the tight spots of the firebox where it was impossible to approach with a standard countersink, and a back countersink was not available, a ball-type rotary file was used to cut a cavity for the weld.

The boiler shell was mounted upside down and the firebox assembly, complete with mud ring, was lowered into place, tacked, and welded around the mud ring.

The firebox door hole was closed out by welding flat strips around the door hole between the back head of the firebox and the boiler back head.

The stay rods, of .187" diameter type 321 stainless steel rod, were cut to length, taper-ground to a 45° bevel on each end, slipped into place in matching holes in the firebox and boiler shell, and rosette-welded on the non-wetted sides of the boiler shell, throat sheet and back head, and the firebox down sheet, back head, and lower part of the aft flue sheet.

The copper tubes were slipped in from the front end of the boiler and flared at both ends simultaneously by a double-ended flaring tool. The ends were sealed by silver brazing the overhang to the flue sheets.



TYPES OF WELDS

FIG. 2

every inch before the continuous beads were run.

A holding fixture was used to maintain alignment of each section with respect to the others. The fixture, or assembly jig, consisted of top, bottom, right and left centerplane profiles of the boiler cut from metal strips and backed with plywood for stiffness. The strips were held in the form of a cage with a base plate at the front end and several hoops along the length of the boiler. The cage was mounted base down with the boiler centerline in a vertical direction.

The successive sections of the boiler, starting with the front section, were applied one at a time, located properly in the jig, tack-welded all around the mating surface, and then butt welded into place.

The front flue sheet, .250" thick, was welded to the first section with a fillet weld prior to stacking the

INSULATION

Reduction of heat losses from a boiler with the consequent increase in operating efficiency is the prime purpose of boiler insulation.

The choice of material is, in most cases, influenced by the availability of suitable materials to the builder.

Characteristics of an ideal boiler insulation are as follows:

1. Extremely low rate of heat conduction.
2. Moisture and waterproof to avoid soaking up moisture or water which would greatly increase the heat conduction rate.
3. Easy to install around the boiler shell, as, for example, a form-fitting blanket.
4. Readily available at a low or moderate cost.

TABLE 1	
THERMAL CONDUCTIVITY RATES	
BTU/hour/sq ft/°F/inch thickness	
Aluminum alloy	1209.00
Asbestos	.828
Cork Board	.300
Fir Wood	.80
Glass Wool	.27
Rock Wool	.27
Magnesia (15% Asbestos)	.39
Masonite	.33
Thermofelt (hair and asbestos fibers)	.28
Themofill (flaked gypsum)	.23
Rock Cork	.33
Celotex	.34
Kapok	.24
Hard Rubber	1.043
Oak Wood	1.44
Dry Sand	2.28
Sawdust	.36
Stagnant Air	.163
Water	4.10

5. Capable of withstanding long periods of temperature up to 450°F.

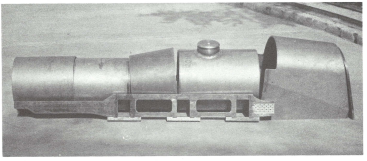
Very few materials, if any, meet all of these requirements. Asbestos in either mat or woven fom, rock wool batts, and fiberglass wool or cloth are all materials which are fairly easy to obtain, quite low in conductivity and capable of withstanding the heat applied. However, water absorption remains a problem, particularly with asbestos.

Woven asbestos blanket, dried thoroughly and coated with a suitable heat-resistant waterproofing material such as RTV silicone rubber or hardening type Permatex, is favored by this writer since it is readily available.

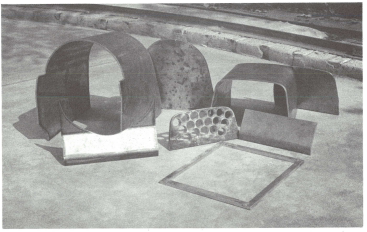
Glass cloth is even better than asbestos if enough layers are used to build up a blanket and if the outer layers are sealed to eliminate water absorption.

Air is an excellent insulator when it is stagnant. However, stagnation is impossible when the heat level varies around the container. Circulation will occur and this will raise the heat transfer rate. The process of filling the insulation space between the boiler and its jacket with a material of low heat conductivity such as glass cloth or woven asbestos automatically displaces part of the air and prevents circulation of the remainder.

Figure 1 shows the rates of thermal conductivity of various materials which might be considered for use as boiler insulation. The conductivity of aluminum is shown for comparison.



DOUGLAS ALKIRE



Boiler parts for a 1" scale B&O "President" Class Pacific built by Douglas Alkire. Shown are stainless steel tube sheets, crown sheets, mud ring, backhead as well as cylindrical and conical sections of the boiler shell.

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SIZE MAKES THE DIFFERENCE

There have been a number of letters from individuals who are engaged in Steam Engineering as a full-time occupation. This letter is not to question their ability, but it does note that such an occupation does not necessarily qualify them to make accurate statements regarding small steam equipment. If it is larger than 1½ scale it could hardly be classified as small and this would apply to almost any type of steam-operated device. My remarks are directed to 1½" scale or less.

LBSC was a master with the design of small steam locomotives and one of his favorite quotes, "Nature cannot be scaled," was used many times in his notes. He could have added, "it is not necessary to scale nature" and also made an accurate statement.

My point is this: in small engines, construction and practices are used that do not conform to full-sized design. For example: in large steel locomotive boilers it is necessary to flange plates but in small arc welded boilers it is not. A small locomotive can be operated safely with thin flanges and the driving boxes and crankpins may be worn to excess. A very dangerous practice on large locomotives but not to the small engine drivers.

A fellow "Cinder Sniffer" is building a 1½" scale "Tich" with a grate area of 4" x 5". A licensed steam engineer informed him that the boiler would not steam because the firebox did not have a brick arch. Oh, come on now . . . !

It isn't necessary to construct a small boiler to a "code" to have a safe, good steaming unit. It is possible to operate without a complete water softening plant — rain water will work. City water will, in time, "lime" a boiler, but this doesn't happen in an instant.

Some advice to the "new ones" in small steam: learn about it and remember it doesn't always scale.

Some advice to the professionals in full-sized practice: stop shaking the big skeleton in the small closet. Learn more about "little steam" and please, don't try to fit the big harness to the baby horse.

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...from the cupola

One of these days, we keep hoping, we will be able to quit using this column to explain our way out of problems that we wouldn't have if it weren't for this project! Our current problem, as many of you are aware, is a BLS Directory which was promised for April 30th and isn't out yet. We know that many planned to use this on summer vacations and we still hope it can be of use in that way to a lot of Live Steamers. In way of explanation, let us summarize in this manner:

The original plan was to print the Directory after the April issue of LIVE STEAM was mailed. We had pushed hard to get ourselves a week ahead of schedule in order to have time to work on the Directory. We picked up the plates for the April issue and started to run them and the results were terrible. We fooled around and kicked the equipment and had some of the plates made over but the result was still muddy half-tones. When the April issue was finally mailed we had lost the week we had gained so decided to push the May issue and get that out of the way so we could get back on the Directory.

Preparation of the May issue set a sort of record around here in that it was completely prepared in less than three weeks — drawings and all. We prodded the plate makers only to find that we were getting the same results as with the April issue. After much fretin' and fussin' and many phone calls, the half-tone negatives were reshot and eight of the ten plates for that issue were remade. We then had satisfactory results, but we had lost another two weeks.

In the meantime we had placed an ad in Model Railroader Magazine to see if we could locate any would-be Live Steamers and the results completely overwhelmed us. More than 500 new subscribers . . . all of whom wanted to be sure to start with the May issue! The mere matter of setting up over 500 new record cards and making (and filing) over 500 new address stencils into their proper place according to zip code was a task that made good wife Doris finally exclaim, "This thing's getting bigger than both of us!"

So we that we decided to have a local printer print the June issue in order to save us some time, but (you guessed it) the matter of turning over this project to someone completely unfamiliar with it ended up taking more of our time than if we had done it ourselves! Continuing to work with them, though, will relieve us of a goodly amount of work here and we will be able to concentrate on getting the Directory out and then get caught up with the schedule for LIVE STEAM. Following that will come a concentration on correspondence and after that bigger and better issues about this wonderful hobby of ours.

We'd like to add one footnote about the Directory. Well over 1,000 indicated interest in buying a Directory when it was ready. Response at this point has brought only about 300 orders which won't quite pay for the paper, let alone the expense of plates for printing. We hope that once we do produce this that there will be a renewed interest in the project that so very many said was necessary.

— W. C. F. —

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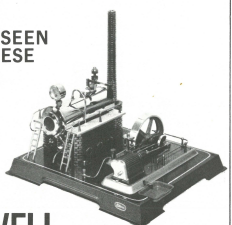

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